# CLAIMS

I/We claim:

1. A multi-channel, optical switch to use light bullets as optical pulses, the switch comprising:

a waveguide of a first material;

a plurality of channels extending from the waveguide, each channel of the plurality of channels to provide an optical path suitable for transmission of the light bullets, each channel formed of a material other than the first material;

and wherein a first subset of the light bullets are to propagate into a predetermined channel of the plurality of channels responsive to interaction with a second subset of the light bullets.

2. The switch of claim 1, further comprising:

a light source channel extending from the waveguide, the light source channel to provide an optical path suitable for transmission of light bullets; and

a light source connected to the light source channel, the light source to provide the second subset of light bullets.

3. The switch of claim 1, further comprising:

a plurality of light source channels extending from the waveguide, each light source channel to provide an optical path suitable for transmission of light bullets; and

a light source connected to the plurality of light source channels, the light source to provide the second subset of light bullets.

4. The switch of claim 3, wherein:
the light source is a single source of light.

5. The switch of claim 3, wherein:
the light source includes multiple sources of light, and one source of light is provided for each light source channel of the plurality of light source channels.

6. The switch of claim 1, wherein:
the light bullets are to co-propagate through and interact within the waveguide to selectively direct the light bullets.

7. The switch of claim 1, further comprising:
an absorption layer extending from the waveguide, the absorption layer to absorb light bullets.

8. The switch of claim 1, further comprising:
a controller coupled to the waveguide and coupled to the plurality of channels, the controller to control operation of the waveguide and the plurality of channels.

9. The switch of claim 8, wherein:
the channels of the plurality of channels may be selectively disabled from transmitting light bullets; and
the controller to selectively disable the channels of the plurality of channels on an individual or group basis.

10. The switch of claim 8, further comprising:
a plurality of light source channels extending from the waveguide, each light source channel to provide an optical path suitable for transmission of light bullets; and

a light source coupled to the plurality of light source channels, the light source to provide the second subset of light bullets, the light source coupled to the controller.

11. The switch of claim 10, wherein:
the controller is to control the light source, the controller to set a power level of the light source, the power level of the light source corresponding to an intensity of the light bullets produced by the light source.

12. The switch of claim 10, further comprising:
a system interface coupled to the controller.

13. The switch of claim 12, further comprising:
a cable interface coupled to a channel of the plurality of channels.

14. The switch of claim 1, wherein:
the first material is a semiconductor material.

15. The switch of claim 14, wherein:
the semiconductor material is composed essentially of Gallium Arsenide (GaAs).

16. The switch of claim 14, wherein:
the semiconductor material is composed essentially of Indium Phosphide (InP).

17. The switch of claim 14, wherein:
the semiconductor material is composed essentially of Gallium Nitride (GaN).

18. The switch of claim 14, wherein:

the semiconductor material includes multiple quantum well semiconductor material.

19. The switch of claim 18, wherein:

the multiple quantum well semiconductor material is composed essentially of Aluminum-Indium-Arsenide/Gallium-Indium-Arsenide.

20. The switch of claim 18, wherein:

the multiple quantum well semiconductor material is composed essentially of Gallium Arsenide/Aluminum-Gallium-Arsenide.

21. The switch of claim 18, wherein:

the multiple quantum well semiconductor material is composed essentially of Gallium Nitride/Aluminum-Gallium-Nitride.

22. The switch of claim 1, wherein:

the waveguide includes a single planar, rectangularly shaped slab of semiconductor material.

23. The switch of claim 1, wherein:

the first material is bulk material to provide the light bullets with other directions of propagation, including directions of propagation out of the plane of the waveguide.

24. The switch of claim 1, wherein:

the light bullets propagate along corresponding travel paths; and

the travel paths are selectively determined by controlling the timing, intensity, and the axial displacement of the light bullets relative to each other.

25. The switch of claim 1, wherein:

the first material is a semiconductor material having a sufficiently negative group velocity dispersion and high nonlinear index of refraction to support the light bullets.

26. A method of switching optical data comprising:

receiving a light bullet in a first optical channel, the first optical channel formed of a first material;

injecting the light bullet into a waveguide, the waveguide formed of a second material different from the first material;

directing the light bullet within the waveguide responsive to a guiding light bullet; and

receiving the light bullet in a predetermined second optical channel.

27. The method of claim 26, further comprising:

injecting the guiding light bullet into the waveguide.

28. The method of claim 27, further comprising:

generating the guiding light bullet in a light source, the light source coupled to the waveguide.

29. The method of claim 28, further comprising:

injecting the guiding light bullet into a light source channel, the light source channel connected to the light source, the light source channel connected to the waveguide.

30. The method of claim 29, further comprising:

absorbing the guiding light bullet after the directing.

31. A method of making an optical switch for use with data embodied as light bullets, comprising:

providing a waveguide of a first material;

connecting to the waveguide a plurality of channels of a second material, the channels to provide optical paths for light bullets, the second material different from the first material;

connecting to the waveguide a plurality of light source channels, the light source channels to provide optical paths for light bullets;

and

coupling a light source to the plurality of light source channels.

32. The method of claim 31, further comprising:

coupling a control module to the light source.

33. The method of claim 32, further comprising:

coupling the control module to the plurality of channels.

34. An apparatus, comprising:

first means for transmitting light bullets, the first means composed of a first material;

means for switching light bullets, the means for switching composed of a second material, the second material different from the first material, the means for switching also for directing the light bullets using interactions between light bullets and for receiving light bullets from the first means for transmitting; and

second means for transmitting light bullets, the second means for transmitting for receiving a light bullet from the means for switching.

35. The apparatus of claim 34, further comprising:

means for producing light bullets, the means for producing for providing light bullets to the means for switching, the means for switching for

directing light bullets using the light bullets of the means for producing.

36. The apparatus of claim 35, further comprising:
means for controlling the means for producing.

37. A router, comprising:
a plurality of input ports;
a plurality of output ports;
a switching fabric coupled to the input ports of the plurality of input ports and coupled to the output ports of the plurality of output ports, the switching fabric including a plurality of interconnected multi-channel, optical switches, each of the optical switches to use light bullets as optical pulses, each of the optical switches including:
a waveguide of a first material;
a plurality of channels extending from the waveguide, each channel of the plurality of channels to provide an optical path suitable for transmission of the light bullets, each channel formed of a material other than the first material;
wherein a first subset of the light bullets are to propagate into a predetermined channel of the plurality of channels responsive to interaction with a second subset of the light bullets;
and wherein the optical switches of the plurality of optical switches are coupled together through the channels of the plurality of channels of each optical switch.

38. The router of claim 37, wherein:

each of the optical switches further includes a light source channel extending from the waveguide, the light source channel to provide an optical path suitable for transmission of light bullets; and

a light source connected to the light source channel, the light source to provide the second subset of light bullets.

39. The router of claim 37, further comprising:

a control module coupled to the switching fabric, the control module to control the switching fabric.

40. The router of claim 39, wherein:

the control module is further coupled to the input ports of the plurality of input ports, the control module to access status information of the input ports.

41. The router of claim 39, further comprising:

the control module is further coupled to the output ports of the plurality of output ports, the control module to access status information of the output ports.

42. A switching fabric to switch light bullets between a set of input ports and a set of output ports, comprising:

a plurality of interconnected multi-channel, optical switches, each of the optical switches to use light bullets as optical pulses, each of the optical switches including:

a waveguide of a first material;

a plurality of channels extending from the waveguide, each channel of the plurality of channels to provide an optical

path suitable for transmission of the light bullets, each channel formed of a material other than the first material;

wherein a first subset of the light bullets are to propagate into a predetermined channel of the plurality of channels responsive to interaction with a second subset of the light bullets;

and wherein the optical switches of the plurality of optical switches are coupled together through the channels of the plurality of channels of each optical switch.

43. The switching fabric of claim 42, wherein:

each of the optical switches further includes a light source channel extending from the waveguide, the light source channel to provide an optical path suitable for transmission of light bullets; and

a light source connected to the light source channel, the light source to provide the second subset of light bullets.

44. The switching fabric of claim 42, wherein:

each optical switch of the plurality of optical switches includes a plurality of light source channels extending from the waveguide, each light source channel to provide an optical path suitable for transmission of light bullets; and

a light source connected to the plurality of light source channels, the light source to provide the second subset of light bullets.